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THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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PLATE VII

MRS. D. A. DUNLAP

Opening the door of the Observatory with a golden key, May 31, 1935.

PLATE VIII

MRS. DUNLAP

In cap, gown and hood as when she received the LL.D. degree from the University of Toronto, May 31, 1935.

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THE DEATH OF MRS. DUNLAP

By C. A. CHANT

(With Plates VII, VIII)

MRS. D. A. DUNLAP, the generous donor of the David Dunlap Observatory to the University of Toronto and the world, passed away on July 31, 1946, after an extended illness. Interment was on August 2.

At the official opening* of the Observatory, on May 31, 1935, some information was given regarding its origin. It was stated that the present writer addressed a letter to Mrs. Dunlap in December 1926, suggesting an observatory as a memorial to her husband who had died two years earlier. This brought forth a cordial response and an invitation to visit her. The visit was made in January 1927. In working out the details of the great undertaking, including the selection of a site, Mrs. Dunlap was always ready with intelligent advice and cordial co-operation.

In addition to the Observatory Mrs. Dunlap had many other interests. In the issue of the Toronto *Globe and Mail* for August 2

*A full account of this opening is given in this JOURNAL, vol. 29, pp. 265-308, 1935. In it some details of the correspondence and interviews which led to the establishing of the Observatory are presented. The progress of the great project is outlined in various articles in previous volumes, as follows: vol. 25, p. 44, 1931; vol. 26, pp. 277, 289, 368, 1932; vol. 27, pp. 281, 401, 1933; vol. 28, pp. 89, 97, 122, 1934.

In the first of the *Publications* of the Observatory (1937) is a full "Description of the Buildings and Equipment."

appears an editorial which refers to some of the activities of her busy and useful life. It is a well-deserved tribute, and is printed below.

A Great Lady Dies

Mrs. Jessie Donalda Bell Dunlap, who died at her Toronto residence on Wednesday, was a woman who found happiness and comfort in her tireless and unselfish efforts on behalf of the community. No worthy cause was beyond her field of interest. The dignity and sincerity with which she approached her manifold lines of endeavor won for her the admiration and respect of those with whom she served.

Only a person of marked ability and personal charm could have accomplished as much in a lifetime as did Mrs. Dunlap. It was natural that following the death of her husband, David A. Dunlap, in 1924, that she would carry on the partnership they shared in numerous philanthropic and social welfare projects. She continued to give generously both in terms of financial aid and personal service.

Her husband donated the Dunlap Building to the Toronto General Hospital and the widow maintained the connection by her keen interest in the hospital's affairs. The late Mr. Dunlap made a hobby of astronomy, and in 1935 Mrs. Dunlap and her son, Moffat, presented the University of Toronto with the David Dunlap Observatory. The university, as a token of gratitude for this splendid help to science, conferred on her the honorary degree of Doctor of Laws.

Mrs. Dunlap took particular pride in the development of the famous Don Alda Farms at Todmorden, which were established by her and her husband. Her fine herds made the Dunlap name known to agricultural circles throughout the continent. In recognition of her valuable contribution to the breeding of Guernsey cattle she was in 1939 elected honorary president of the Royal Winter Fair, having previously served on the fair's board of directors.

Mrs. Dunlap gave most freely of her time to the church and its work. When war came she cheerfully accepted new and onerous burdens, and in 1940 was made chairman of the War Services Committee of the National Council of the YWCA. With this admirable record of public service, it is inevitable that her passing will leave many gaps in the social and cultural life of the community. She was, it can be truly said, an outstanding woman, and her accomplishments will stand as an inspiration to others to serve as she did.

It was announced that the funeral would be private and it was requested that no flowers should be sent. However many of her friends could not refrain from sending some token of their high respect and admiration. These flowers were placed in the beautiful conservatory adjoining the living room of the residence. On the floor

beside the casket was a large oblong basket of simple flowers from the garden, and upon the casket was a handful of violets.

Mrs. Dunlap is survived by a son, David Moffat, who was associated with her in founding the Observatory. On September 10, 1932, he laid the corner-stone of the beautiful Administration Building. Upon the announcement that Canada would participate in the war Mr. Moffat Dunlap volunteered for service, although he was married with two children. He enlisted as Lieutenant, November 1, 1940, and proceeded overseas in October 1941. He was promoted to be Captain in January 1943. He served with the 3rd Anti-Tank Regiment, Royal Canadian Artillery, and then with the Light Anti-Aircraft Regiment, R.C.A., from January 1943 to the end of the war. He was mentioned in despatches in 1945 and discharged July 1946.

Mrs. Dunlap's grave is beside that of her husband in Mount Pleasant Cemetery, and on the near-by modest monument is inscribed:

DAVID ALEXANDER DUNLAP

Born October 13, 1862; died October 29, 1924.
"Held in the peace that holds the earth and stars"

Richmond Hill, Ont.,
August 15, 1946.

MONTREAL TO STELLAFANE

By Isabel K. Williamson

(With Plate IX)

At seven o'clock on Saturday, August 3rd, twenty-five members and interested friends of the Montreal Centre gathered at Victoria Bridge and the six cars, bearing "Montreal to Stellafane" pennants, were soon en route to Springfield, Vermont. For the majority of us it was a new experience for the Springfield Telescope Makers Convention had not been held since the summer of 1941. Our party included Mr. & Mrs. Walter Darling, F. DeKinder and his son Louis, Jacques Desjardins, Mr. & Mrs. A. M. Donnelly, M. Duquette, G. Emond, DeLisle Garneau, C. M. Good, M. Greignon, J. E. Guimont and his son Noel, Mr. & Mrs. F. W. Henshaw, Mr. & Mrs. S. Herscovitch, Francis Morgan, Wray Morton, Professor & Mrs. R. H. Patten and Miss Patten, Mrs. R. J. Williamson and the writer.

Of this group many could really qualify as A.T.M.'s while none could be accused of coming "just for the ride". The veteran telescope maker of the Montreal Centre is Alf Donnelly, who has completed several instruments, including a 9-inch Newtonian. He has a Cassegrainian in the course of construction and we hear that he has a 12-inch hunk of glass awaiting the odd spare moment. Frank DeKinder, while not a glass-pusher, has built his own observatory, installing an equatorial mount with clock drive for his 4-inch refractor. Frank Henshaw has made two 5-inch reflectors and is collecting material for an 8-inch—this in addition to lending a helping hand to other telescope makers. S. Herscovitch, one of our more recent members, tackled telescope making with an energy and speed that amazed us all. He had his first telescope in operation within three months, and just one month later a "richest field" appeared on the scene. Next on the programme is an 8-inch, we believe. Charlie Good, as he himself admits, comes just under the wire, having reached the fine-grinding stage on his first mirror, and the writer has at last completed, with due acknowledgment for help received from Messrs. Donnelly, Henshaw and Matthews, a 6-inch Newtonian.

Despite a deluge of rain at the start, we enjoyed the drive down through the Green Mountains of Vermont. The six cars had planned to meet for a picnic lunch, but either we were too excited to listen

PLATE IX

Club House

Observatory

STELLAFANE (Shrine to the Stars), SPRINGFIELD, VT.

MONTREAL VISITORS AT STELLAFANE, AUGUST 3-4, 1946.

Standing (left to right): DeLisle Garneau, Mrs. R. J. Williamson, F. DeKinder, L.DeKinder, M. Duquette, G. Emond, J. Guimont, J. Desjardins, W. H. C. Morton.

Sitting (left to right): F. W. Henshaw, Mrs. F. W. Henshaw, C. M. Good, Miss I. K. Williamson, J. E. Guimont, M. Greignon, S. Herscovitch, Mrs. S. Herscovitch.

carefully to instructions or too eager to get to Stellafane, for somehow or other each car managed to miss the others. (This inability to get together at an appointed time and place is a sad reflection on a group that claims a fair degree of accuracy for its astronomical observations!)

Just outside of Springfield we turned off the highway and began the climb up Breezy Hill. Halfway up we left our car in the parking space provided and continued the rest of the way on foot. Soon we caught a glimpse of Stellafane through the trees—exactly like the familiar photograph in *Amateur Telescope Making*. It is 1,290 feet above sea level, we learned from the brass plate inserted by the United States Geological Survey. ($250.00 fine for disturbing it.) On reaching the summit we found groups of people chatting together or busily assembling telescopes. The thing that struck us immediately was the informality of the gathering, an impression that stayed with us throughout the convention. No one waited for introductions. Some people we recognized instantly from their photographs—Russell Porter and Albert Ingalls, for instance—but there was no way of distinguishing the other "big shots" except that—well, after you had been in conversation with one for a few minutes you discovered that he knew considerably more about the subject under discussion than you did.

The little Club House where we registered upon arrival contained much of interest. Photographs and drawings lined the walls. Off in a corner was one of the famous "Porter Garden Telescopes". And on the book shelf we came across one or two rare "first Editions". These things, however, we discovered later, for just then we were impatient to inspect the telescopes assembled outside.

Among the fifteen or more instruments set up on the hilltop were several outstanding accomplishments of amateur telescope makers. An 8-inch Schmidt camera, which carried a 3-inch refracting telescope for following and a 1-inch wide-angle finder, deserved and received a great deal of attention from the visitors. This instrument was equipped with an electrically driven slow motion drive in right ascension. A feature of the camera, reflecting the ingenuity of its maker, was the cell for the primary mirror made from an aluminium pressure cooker. A 12½-inch Cassegrainian, having an effective focal length of twenty feet, contained some innovations that only an ardent A.T.M. could think up. The "blind spot" on the secondary mirror

was utilized as a finder. The polar axis, a 1½-inch pipe, was fitted with an objective at the north end, with a prism near the south end, and an eyepiece which was used to line the scope on Polaris. This telescope also had a clockwork drive, using the works of a mantel clock and a single worm and ring. A very fine sample of the Springfield mount was on exhibition also. This was an 8-inch instrument mounted on a circular steel plate with a 3-inch pipe as a post. The telescope was carried on ski-racks atop the owner's car and could be assembled in a very few minutes. No two instruments were alike and we could have spent a much longer time examining the details of each.

Back of the Club House long tables had been arranged and there we gathered for supper. The Secretary, John Lovely, informed us that 378 persons had registered. To serve a hot meal to that crowd on top of a mountain was, we thought, quite an achievement.

After supper we gathered again around the observatory for the highlight of the evening—the talk by Russell W. Porter, now Dr. Porter, having had the degree of Doctor of Science conferred on him this spring by Norwich University. Dr. Porter first spoke of the war years when, in spite of his age (he is now 75) he was expected to work at high pressure, turning out hundreds of cutaway drawings for the Office of Scientific Research and Development. He then spoke of the 200-inch telescope. "The mounting", he said, "is nearly ready to receive the mirror. The mirror is in the last stages of figuring and lacks only a few wave-lengths of a paraboloid." The dome is revolved every few days and the tube swung in right ascension and declination to keep the bearings lubricated. As Dr. Porter pointed out, much has been written about the construction of the 200-inch, but he referred briefly to its four major improvements over previous instruments. An unusual feature is the arrangement for the observer to work at the prime focus of the telescope, actually inside the tube, thus avoiding loss of light through additional reflections. With the bearings resting on oiled cushions so that the instrument is practically floating on liquid, friction has been eliminated to such an extent that a touch of the finger will move it. Automatically corrected drive and setting controls compensate for residual structural deformations, errors due to atmospheric refraction and other variables, while a robot supplants the former assistant, operating auxiliary mirrors and shutters and focusing the unit as a whole. It is a coincidence that

the area of the Mount Palomar Observatory is almost that of the Pantheon at Rome. Albert Ingalls, we were told, had remarked to Dr. Porter, in his usual cryptic manner, that he hoped the Mount Palomar would be in as good condition 2000 years hence as the Pantheon is today.

The next speaker, Albert Ingalls, literally needed no introduction. Well known to telescope makers as editor of *Amateur Telescope Making* and for his "Telescoptics" feature in *Scientific American,* he talks in the same easy, humorous style that characterizes his writing. He told us briefly about the group of amateurs who during the war years produced 28,460 roof-prisms.

Dr. Duncan MacDonald, of Boston University, then gave us an eye-witness account of the Bikini bomb tests. The initial flash was, as expected, of about the same brightness as the sun. It was then completely washed out by a Wilson Cloud Chamber effect, a high-pressure wave travelling outward at terrific velocity and slowing down to the speed of sound, and the 40,000-ft. cloud presenting a lovely sight—pearly white, with streaks of red and orange. To the observer twelve miles away it sounded like the crack of a whip, with no preliminary rumbling, and the pulse of warm air made the plane shudder as though someone had slammed a door. Astronomically speaking, the blast resembled a nova. The initial spectrum showed the emission lines of an O-type star and then dropped to a late spectral type star.

Dr. George Dimitroff and Dr. James Baker, co-authors of *Telescopes and Accessories,* were among the visitors to Stellafane. Dr. Dimitroff, in speaking of the devastation caused by the atomic bomb in Japan, said that he was impressed, not so much by the extent of the destruction, but by the fact that it had taken only one plane and one bomb. Dr. Baker told us about the members of the Boston Telescope Club who, from 1941 on, made lenses for aerial cameras which required a surface accuracy of one-quarter wave-length of light.

Dr. John Strong of Pasadena gave a brief description of how mirrors had been "figured" by depositing a thicker coat of aluminium on zones that were too low.

Dr. Donald Menzel, of the Climax Observatory, where they have "nine months winter and three months poor skiing", showed moving pictures of solar prominences. This is a field of observation that will soon be open to the amateur, he said, when filters of ammonium

phosphate crystals are available, and he expressed the hope that many amateurs would take it up seriously.

David O. Woodbury, author of *The Giant Glass of Palomar,* gave an amusing account of a flight over the Arctic. Weighed down by 55 pounds of "extreme foul weather equipment", he felt at a disadvantage in the plane piloted by two adventurous lads whose ages totalled less than forty.

The last speaker was Dr. Charles Smiley of the Ladd Observatory, Providence, R. I. Telescope makers, he said, are not always telescope users, and many an instrument after it is completed finds its way up to the attic. He urged that an effort be made to get every telescope in the country into use. He suggested, for instance, that the owner might lend an instrument to the A.A.V.S.O. on the understanding that the observer using it send him reports at five-year intervals to the mutual satisfaction of both owner and user. Standard parts for telescopes, he thought, would encourage more observers to make their own instruments, but above all he urged that every amateur choose a field of observation and then get to work and really enjoy himself.

The evening's programme closed with a recording of Everett reciting his well-known "Trip to the Planet Mars" as he did at each convention in days gone by. Sitting on the hilltop, listening to these talks, and knowing that we shared a common interest with the folk gathered there, was an unforgettable experience. It was with reluctance that we broke the spell.

Breakfast was served on the mountain next morning, thus giving the visitors another opportunity for informal discussion, but soon the cars began to head for home. We were among the last to leave at eleven o'clock.

Looking back, it seems to us that the whole theme of the convention, whether intentional or not, was a challenge to the amateur to continue the good work. During the period of the war he had proved his worth, performing tasks that required untiring devotion and exacting skill. Now it was up to him to show that he could take on the equally important work of peace time.

5473 Coolbrook Avenue,
Montreal 29,

10th August 1946.

WEATHER CYCLE AND SUN-SPOT ACTIVITY

By Paul H. Nadeau

BY its rotation about its axis, the sun brings towards the earth the same centre of activity every four weeks or 28 days as a mean. This is the average synodic period of the sun's rotation. We know that these local disturbances on the surface of the sun are the origin of the variation of weather on the earth, even if we do not know how they work.

Let us suppose that the activity of these centres continues in approximately the same state during their different successive returns. Then these centres should have the same effect on our atmosphere, and the weather characteristics of a region on the earth should repeat every 28 days.

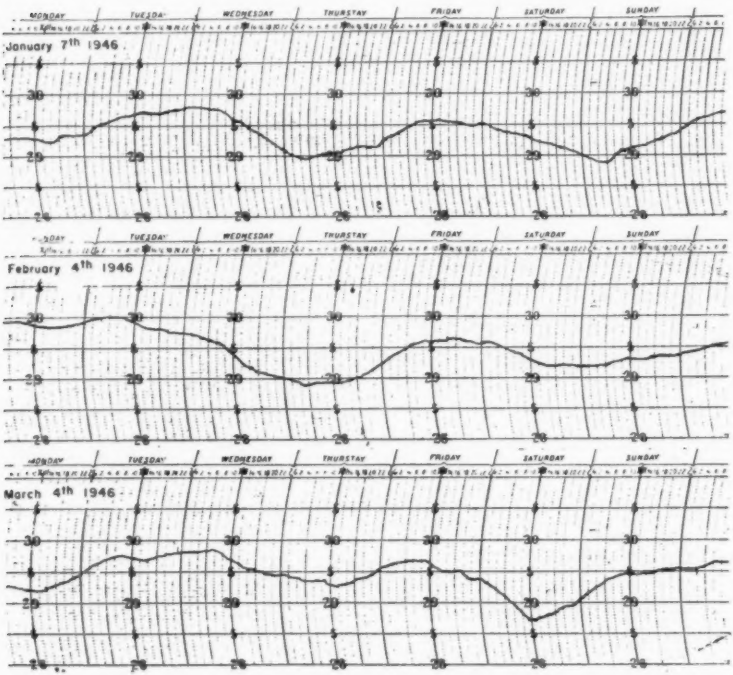
After five years of observations and tests we are able to say that the existence of this 28-day cycle for our region of Quebec City is beyond all doubt. We used it for long-range forecasting of weather and the predictions were surprisingly accurate, in general. Forecastings for a special day were good two times out of three, but those covering the general conditions of a whole week or a week-end were rarely in fault.

This difference of success between day and period predictions can be explained by the fact that the 28-day synodic rotation of the sun is only an average. At the latitude of 40°, the return occurs after 29.37 days; at the latitude of 16°, after 27.07 days; and at the latitude of 5°, after 26.77 days. The axis of the sun being also inclined to the ecliptic, the spots never return at the same point of the solar disc and their action on the earth may vary somewhat.

The similarity of weather vanishes ordinarily after two or three cycles — the length of a season —but we sometimes observed its reappearance for a new cycle. The mean synodic rotation of the sun is exactly of 27.25 days, but the length of the weather cycle is rather of 28 days than of 27 days. The barograms rarely indicate the similarity expected. Nevertheless, the accompaying figure showing the atmospheric pressure of three corresponding weeks is very eloquent.

There is often something true in the popular saws concerning the

weather, for they are based on secular observations. In this case they must have a scientific explanation. Here is an interesting one: "When it rains on Trinity Sunday, it shall rain seven Sundays in a row." Deprived from its ingenuous form, it becomes: "When it



Atmospheric pressure of three corresponding weeks in January, February, March, 1946.

rains on successive Sundays, or any other days of the week, this series of bad days may continue very long." We suggest the following explanation. Suppose that by chance two or three succeeding Sundays are rainy days, then with the cyclic repetition it may be possible that we shall observe a long series of rainy Sundays, and this is enough for considering the saw correct.

The layman attributes to the moon much more influence on the weather than it has in reality, and has not the least idea that this belongs rather to the sun. A reason for this mistake is that he is not acquainted with the activity and rotation of the sun, as well as he is with the phases of the moon which repeat themselves every 29 days as an average, and very often after the same time as the synodic rotation of the sun.

When I was a schoolboy, I was struck by the fact that many times during the whole seasons it was raining on Thursday, the holiday. This winter also was characteristic in that respect. Like many of the winters of our country, it was characterized by alternative cold and mild periods; rain occured every month, at approximately the 28-day period. From October to the present date, every Friday but three, had precipitation or almost cloudy sky during the evening and night.

As a matter of conclusion, observations give evidence in favour of this weather cycle of 28 days, although we register on occasions many exceptions. The interesting point will be to predict when these exceptions may occur, and this can be achieved by more careful observation of the sun.

Quebec, April 30, 1946.

HER MAJESTY'S MAGNETICAL AND METEOROLOGICAL OBSERVATORY, TORONTO

By A. D. Thiessen

(*Continued from page 226, vol. XL*)

Lefroy wished to have meteorological observations taken at some of the Grammar Schools in Canada,[95] and tried to induce the Government of Canada to pass a bill providing for the equipment of certain Grammar Schools with meteorological instruments. Such a measure was not passed, however, until the year 1854, under the guidance of Professor Cherriman and Sir Francis Hincks.[96] The subject appears to have been mentioned first in the following letter:

Toronto, Sept. 5, 1850

Dear Colonel,

The first half of a letter which I wrote yesterday having unaccountably disappeared, I sit down at the last moment to rewrite it, and if it is not joined very artistically to the latter half, mention the circumstance in explanation. I have received your letter from Lucerne, dated Aug. 9, and referring chiefly to the scale of the Photographic Bifilar. I will readjust the instrument and adopt the small scale you direct, but as extreme disturbances occur exclusively at night, I presume you will not object to my retaining the present comparatively open scale until the difficulty about obtaining curves by artificial light is overcome. I have not yet heard on the subject from Mr. Ronalds. It surprises me that he should not have said something on the wide difference between the degree of sensitiveness required for artificial and for daylight. I found some experiments on the subject in one book only, the writer of which obtained the images of the flames of various lamps and candles in his camera, and by allowing them to act a long time, say 10 seconds, succeeded in impressing them, but speaks of it as a matter of difficulty. I have several times during daylight darkened the room, and applied a lamp for a given time, an hour or half an hour. The result has in every case been a blank, as complete an interruption as if no light were acting at all. The actual experience of Mr. Ronalds would be highly valuable. I think it a question whether the weak solution of bromine which he gives as an accelerator, is quite sufficient. The capsules are of different degrees of color, some of them colorless, the bromine having of course evaporated from all these. It seems a possibility that it is generally reduced in strength. I have however tried both this bromine water and an American compound, without perceiving much difference in their properties.

[95] *Canadian Journal*, 1853, pp. 254-55.

[96] *Ibid.*, 1854, p. 410.

With regard to the question of light, I shall be glad to learn whether you intend to apply for an increase of our contingent to meet the heavy expense of these instruments in that item. Although several weeks have passed since Mr. Renwick promised me information about the apparatus in use at Washington, he hasn't sent it, but I have heard from the proprietor of some Oil Gas works at Norwich, Mass., who states that the expense of the apparatus will be from $300 to $500, and that the gas cannot be made under $6 a 1000 feet. I should say from the price of oil here that it will be more nearly $7½, but oil gas possesses about three times the illuminating properties of coal gas, and therefore a less quantity need be made. It cannot however, on the most favorable supposition come to less than £100 a year. What are the statistics of the Greenwich consumption? It musy be easy to ascertain that.

At present the plates are only used habitually by daylight. Now and then, for experiment, a second plate is applied in the evening, but the effect of the lamps can be better ascertained in the way I have mentioned.

I believe that the Vertical Force instrument will prove a failure. The line never deviates sensibly from a straight one. I have raised the centre of gravity to the utmost, so as to make it very difficult to balance it all. Independently of the difficulty of securing perfection in the axles and agates of this instrument, which has caused many of them to fail, and the theoretical difficulties introduced I cannot but think by adding to the magnet so many and weighty appendages (bar 1 lb. 9 oz., additions 0 lb. 3 oz.). I find it particularly obnoxious to the attacks of spiders, and constantly find the magnet fixed by them. The box being completely closed, there is no way of detecting them but by removing it every day, at the risk of disturbing the adjustment. I am as much as ever at a loss about regulating the coefficient of this instrument.

You have more than once referred to the "optical power" used, or to be used in measuring off the traces. I do not well know what you refer to. No magnifiers were sent. I use the ordinate scale of 50 div. to the inch, and enter habitually to tenths of divisions which equals .002 inch, using a small lens to assist the eye when the line is strong. A very faint line can be seen better without the lens.

Before receiving your views upon the subject, I had applied a wooden wheel to the V.F. clock, to reduce the time scale, by advice of Mr. Ronalds, as it is evident that until we can affect the plate by artificial light at a rate of motion giving the open time scales we must make it sensitive first at rest and next with a slower motion. I have not yet removed this wheel, but employ it solely as subservient to that experiment, when the difficulty is overcome. I shall make exclusive use of the open time scale.

I shall feel much obliged by a communication, in as much detail as the case permits, of what your ulterior scientific objects in the employment of these instruments are. You have said Disturbances. I suppose their magnitude, periodical laws and special peculiarities. But what are disturbances? Is every inflexion in an otherwise regular line to be regarded as one? If so the verbal record must become intolerably minute and detailed. And what is to be done when the trace is one succession of small undulations, without a single bold feature for measure-

ment or description. The traces on gelatinous paper are an assistance; I doubt their power of replacing for all purposes of reference, the actual plates. I have heretofore been in the habit of tabulating the hourly ordinates and adding marginal notes and remarks, where there appeared to be anything to remark, but there appears to be no reason at all for tabulating hourly ordinates, or equidistant ordinates of any kind, if, as you emphatically state, no attention is to be paid to the diurnal movements. The mere enumeration of movements belonging to each hour of time is not so easy as may be supposed, and the smaller the scale, the more difficult it becomes. I may state my difficulty best perhaps by begging you to refer to the curves of H.F. at Toronto (in the published volume) for November 1842, which however offers stronger inflexions than you must often expect on the plates, and that you will say what you would desire to have recorded in writing, as the memorial of that day's work, before effacing the trace which I suppose that to be.

The boxes by the *Gentro*, containing the apparatus of Mr. Brookes and the standard thermometers, have not yet arrived. I found on enquiry a few days ago that the merchants in the town are only beginning to get their goods by her. It can scarcely be many days before we get them. I wish to mention the circumstance that the ordnance have not communicated to their people here, and that we are without funds. I do not write again officially because I have already done so twice, and on the second occasion Younghusband mentioned that you had represented the matter in May. Of course I shall not establish a Gas apparatus on my own responsibility or risk, neither shall I incur any very heavy bill for oil. We have only used three or four pound's worth as yet. The builder by whom the alterations were made in May and June, would be glad to get his money I know, but he told me the other day that he had not made out his account, as he knew there were no funds. I am therefore not pressed by him.

I believe I have answered your question as to the degree of precision with which the curves can be tabulated. I use a scale of 50 div. to the inch and enter habitually to tenths, assisting the sight by a small lens. The time scale being one inch to an hour, admits of estimation to about half a minute, that is to say say to the tenth of one of the divisions of five minutes. In all these instruments there is a question introduced by the circumstance that the ray of light has sensible dimensions. It is not a point but a square patch, covering (in Ronalds) about 4 minutes on the time scale; consequently it is, I apprehend, open to question how far any small movement belongs to that instant of time opposite to which it is found. Its edge certainly does not do so.

I inclose an extract from a Grammar School bill of which I procured the insertion. The bill is lost for this session. I found that members of the Legislature generally evinced a good deal of interest [in] the subject, and the future maintenance of the Observatory by the colony will certainly be materially promoted by the temporary presence of the seat of Government here. The Governor General visited the Observatory not long since, and appeared to take a very intelligent interest in it, and Lady Elgin even more.

I hope your health will continue to improve, and that Mrs. Sabine and yourself will derive much enjoyment from your visit to Switzerland.

Believe me, Yours very truly,

J. H. LEFROY.

Here follows a letter from F. Ronalds, Lefroy's instructor in the new method of photographic recording in England.

Kew Observatory, Old Deer Park, Richmond,
September 10, 1850.

My dear Sir,

I had begun a long letter to you and had continued it (at such intervals as I could scratch from all other passing work) in reply to several Letters which I have been favored with from you previously to your last of the 16th ult.; but you have really begun your operations on the H.F.M., etc., so much better than I expected that much of what *appeared* necessary to be said in reply to several of your questions, etc., seems now to be no longer requisite.

I now write provisionally and chiefly to express great surprise at your not having (after succeeding so well with day-light) been able to procure impressions with lamp-light, for I can assure you that one of the lamps sent with the H.F. instrument is that which was used with that instrument to procure many impressions of which lamp-light parts are stronger than those parts which were procured by mid-day light, and I can also assure you that we have very often, since, had similar results, generally the difference of day-and-lamp-light effect is extremely small. In order to procure the best effect of the lamp, it should be often cleaned, and all the oil should be poured out (of the lower part particularly) whenever the lamp is removed (whilst it is warm) in order to get rid of matter which has been in the frames, etc. It should be so placed that its chimney should be at scarcely more than half an inch from the end of the camera (at 6 o'c.) and having removed both the shields (a' and b'). The screws in the corner of the dish should be employed to adjust the lamp to such height that the parallelogram of light thrown upon the back of a' should have an equal margin—both above and below the edges of the aperture at the back of a'). This adjustment must, of course, be made in a darkened room, and with the flame in good order and the camera box removed. If after this the shields are accurately adjusted in the mirror I have before alluded to (or perhaps the reverse for the H.F.M.) and if your plates are as well polished as ours (I *think* they are better polished) and if you have good olive oil, you *must* I am sure succeed. But I am very glad that your project of using gas-light is likely to answer; it will doubtless save money and the "detestable" but *very necessary* process of lamp-cleaning, and I shall await the result of your trials in gas-making, etc., anxiously in order that we may profit by your experienec. I hope you will begin immediately. The impressions on very Common (or coarse) silver paper which you have sent me, give me strong hopes that your printer will be very soon able to furnish you with excellent impressions. There seems to be no fault in

the firmness of the line or in the burring (perhaps it might be cut a little deeper) and I attribute your want of greater success in great measure to the flimsiness or tenderness of your *Hat-paper* which did not admit of damping sufficiently without tearing or sticking. The paper which I have found best is well-known to copper-plate printers as "India-proof-paper". It is, or should be, composed entirely of silk; it is soft and therefore enters the line well and is very tough; therefore it can be damped a *little more* than other papers (especially such as may contain more or less cotton) without so much danger of sticking to the gelatins as them, but even this requires care in the damping.

It should be left in the damped (colombier) quire not longer than 3 or 4 seconds and the hand or fingers may be lightly slid over the outside of the quire as if you were using a blotting paper-case upon a letter. I will endeavour to send you some India-proof-paper of the best to be had in London with this letter and will beg the favor of Captain Mortreo to send some real India silk for us all. But after all I fear that you are quite right in attributing great inconvenience to your hot weather in this matter. Could you keep a little press cool artificially? or use one in a low cellar?

Turning now back to some of my former rough draught memos. I will make a few remarks relative to your former questions, etc.

1st. The Pully (*I*) is attached to the barrel arbor of the Clock by means of a nut and screw which nut being released allows you to set the hours on the pully at which you start the clock to the required time, but it is better to disregard the figures on that pully and to bring the XIIth mark to the Index and reckon your time from that hour.

2nd. I have sent herewith a copy of the description of the Vert. Force Magnet from my report which *may* perhaps clear up two or three difficulties alluded to in your former letters.

3rd. In respect to your Photographic Manipulations I may safely say that you have succeeded better than I did by far at first and will I *hope* and *believe* soon so far improve upon our old-fashioned method as not only to satisfy yourself but give us better means of satisfying ourselves here, for I am well aware that the American Photographists are very clever. You cannot detest more than me (*sic*) that oil and rotten stone, but we cannot as yet *as we think*, get rid of the Mercury on the plates without it.

4th. As regards the time consumed in the metallic process, etc., I would beg leave to remark that I hope it will not ultimately *need* to be greater than that consumed in the paper process; for I hope it will not be thought necessary both to tabulate ordinates and to make tracings of every day's work in the Camera and that the Daguerreotype process will be at *least* as short as the Talbot-type in the preparatory parts. By the bye I think it were proper to remind you that the Metallic process is not exclusively a part of my inventions. I began long before anyone else to use Talbot-type (for electricity, barometer, etc.) and my apparatus in its present state is quite as well adapted for one as the other. It only requires that, for *focussing* the ground surface of the little piece of glass at the top of the frame *H* should be reversed and plates of Glass used (to put the

paper between) in the place of the metallic plate. But you will soon find that the metal is best if only on account of greater sharpness, etc.

5th. In reference to the scale, I will just remark that I followed orders, and greatly to my dissatisfaction (as a showman) have been obliged to exhibit straight lines in lieu of curves, but pleased to find that I had executed my task satisfactorily to our excellent friends.

F. RONALDS.

To Capt. Lefroy, R.A.,
Toronto.

Lefroy is expecting more instruments.

Magnetic Observatory, Toronto,
Sept. 12, 1850.

Gentlemen,

I have not yet received or had any intelligence of two boxes ex *Gentoo*, containing instruments for the Magnetic Observatory, which you assured me a month or six weeks ago should be forwarded with all possible disptach. I have to request your enquiry respecting this extraordinary and most vexatious delay.

I beg to inclose the Bill of Lading of another box shipped on board *Great Britain*, the contents of which I have noted thereon.

I remain Gentlemen,
Your obedient servant,
J. H. LEFROY

Messrs McPherson Crane and Co.,
Montreal.

Investigations into the use of gas as an illuminating fuel are continuing. They are referred to in the following letters.

(*Copy of Letter from F. W. Treadway, Norwich, Ct.*)

Capt. J. H. Lefroy

Sir). Yours has been received. Very soon upon the receipt I penned a long letter to you upon various kinds of gas, and should have sent it, but about that time I saw your acquaintance Mr. Hunt who I believe is connected as chemist with the Geological Survey, and from conversation with him I became satisfied more fully than before of what you wanted. I think you cannot get any light that will suit your purpose constantly except the oil gas and that with the sized apparatus that you would require would be pleasanter and better in point of expense and manufacturing than anything else. I think with the sized apparatus you would require you could safely calculate upon getting from 15 to 130 feet of gas from a gallon of oil, as I perhaps intimated in my former letter. The yield depends very much upon the length of main pipe and pressure both of which

would be very favorable in your wants. I have seen a yield of 135 feet in a small work as for the furnace I use, I can use rosin just as well as oil and have done it, and do do it owing to the price of oil, but I should not use rosin if the light was for myself only. The only trouble I think of to which you would be subject would be that at times the gas would be liable to smoke a little owing to its having too much carbon in it, but this is very readily and easily prevented. I should advise a small works designed only for oil and I think that at almost any price that common oil can go to you could produce the light you want cheaper than you could get the same amount of light from any other gas, or in any other way, and the whiteness of the light it is very certain is superior to anything else, and that is the better from being made from oil alone. In your communication you say the retorts and gasometer must not contain any iron; I hardly know how you would be able to make gas without having an iron apparatus. All [except] the gasometer may be of the metal you desire, and a gasometer may be made of gutta percha or perhaps of lead, but you cannot to my knowledge manufacture gas without some iron. If you received gas from the public works your gas must come through—be manufactured and stand in iron. If it is the attraction of the iron, let it be further from your premises. You can get along with lead or copper with oil after leaving the gasometer.

I understand from Mr. Hunt that there must not be any iron near or in the Observatory. A gas may be produced by electricity from water which requires less iron than any other, or perhaps without any at all, but this would be a very expensive light. If the economy of the light is to be taken into account at all I think you would be compelled to abandon the idea unless iron can be used. A lead or copper pipe the size that would be required from the public works would cost very much more than a private works and then you do not get over the iron difficulty.

I gathered from Mr. Hunt that about the [?] only be the difficulty with iron, but the whiteness of the light and uniformity in illumination were the points which you wished to gain and that I think can be gained most successfully with the solar gas, and if you choose to mix oil and rosin you can do so, and get a good light. I perhaps have not communicated what you most wish but if so I should be happy to do so, at any time as far as is in my power.

Very respectfully yours,
(Signed) F. W. TREADWAY,
Superintendent Oil Gas Works

Norwich, Ct., Sept 20/50.
A true copy (J. H. Lefroy).

(*Extract from a letter from Mr. Kent, manufacturer of Philosophical Apparatus, N.Y.*)

I send with this a copy of my catalogues in which at page 52 + 53 you will find a description of a small oil gas apparatus, but I think it is hardly large enough for your purpose.

I can furnish such as is there described, but could not make a larger one. A copper retort would become useless after heating red hot a few times. It must be of iron. A gasometer made of India rubber cloth would not answer for practical use, the empyreumatic oils produced in the manufacture of the gas would soon dissolve the rubber (see catalogue page 53 at bottom). The above description in catalogue will furnish the information you ask in reference to the quantity of gas obtained from a gallon of oil.

You will observe that my apparatus is made and intended only for illustrating chemical lectures, but if you think that it will answer I can furnish any article described in the catalogue. As I do not profess to be a manufacturer of gas apparatus, I would prefer to decline making an estimate for any larger than that referred to as I could not furnish the apparatus. I have understood that Toronto is lighted by Public Gas Companies. If this is true it would be more economical and far less trouble to you to obtain your gas from them even if you have to bring it a considerable distance through pipes. This fact is owing to the trouble attending the manufacture of gas on a small scale, and having become convinced of this I shall leave out the description of my oil apparatus, in a new edition of my catalogue which I am now preparing for the press.

Prof. Renwick is decidedly in favour of making gas. The catalogue says that a gallon of common oil, costing at New York 75c (3s.) will make 100 cu. ft. of gas which will burn about 70 hours from a common fish-tail burner at a cost of little more than 1 cent an hour, about 1s. for 24 hrs.

J. H. LEFROY

By September 26, 1850, the expected shipment of instruments has arrived.

Toronto,
26th September, 1850.

My dear Colonel,

I have the pleasure of reporting the safe arrival of Mr Brooke's apparatus on the 24th instant after I had given up hopes, and thought they must have been on board a vessel that was wrecked. (There were two *Gentoo's.*) The boxes were sent here in a cart by the acting storekeeper without one word of advice or explanation, nor have I been able to learn anything about them. I was not aware that they had been sent officially through the Ordnance, and consequently made no enquiry in that quarter, but wrote to the usual forwarders, whose reply was that they were not on board the *Gentoo* whose arrival they had reported to me, and must have been on board the *Gentoo* that was wrecked. My belief is that they were put into the Ordnance store at Quebec two months ago and forgotten, that they came in the first vessel, but being regarded as Ordnance property were not in her manifest, whence the mistake of the forwarders. The loss of time is very provoking, but they have arrived in perfect safety. I had intended adopting one of our box chronometers for a time-piece, but as the *Great Britain* is also in

port, and the box by her may be expected in a few days it is not worth [remainder of letter lost.]

. . . . . .

a thermometer for low temperatures in New York as in London, probably a much better one, as Prof. Guyot and the Smithsonian Institution have taken great pains to find a maker. They employ a man named Green. Shall I order one from him? This paper will not bear crossing. Believe me, Yours very truly, J. H. LEFROY.

Observatory, Toronto,
5th October, 1850.

Gentlemen,

On the receipt of your letter of the 14th September relating to the missing boxes ex *Gentoo* I wrote the Ordnance Storekeeper at Quebec inclosing the Invoice, and requested him to see your agent there. I have since received these boxes through the Ordnance Department, to which I was not aware that they had been consigned, and with which the delay complained of appears to have exclusively originated. I now however trouble you to state that the box ex *Great Britain*, the entry of which you announce in the same communication, has not come to hand, although I am informed by other parties, that they have for some time been in receipt of goods from that vessel, and I shall feel much obliged by your inquiry if it has been duly dispatched.

I am Gentlemen,
J. H. LEFROY, Captn. R.A.

(*To be concluded*)

REVIEW OF PUBLICATIONS

David Rittenhouse, Astronomer-Patriot, 1732-1796, by Edward Ford. (vii + 226 pages, 5¼ X 8 in. Philadelphia: University of Pennsylvania Press, 1946. Price $2.50.)

This is the tenth volume in a series entitled "Pennsylvania Lives" in course of publication by the University of Pennsylvania Press.

David Rittenhouse's life-span of sixty-four years included the stormiest period in the development of the commonwealth of Pennsylvania and of the union of the American colonies.

Rittenhouse was born a few miles north of Philadelphia in a stone house built by his great-grandfather who was the first papermaker in America. His father wished him to be a farmer, but the lad's slender frame could not stand the heavy labour. Moreover from his childhood he showed an inquiring nature and a fondness for tools. Also, he early exhibited a genius for mathematics. Newton died in 1727, only five years before Rittenhouse was born, although his *Principia* was published in 1687. In 1744, on the death of an uncle, Rittenhouse came into possession of a chest of tools and an English translation of the First Book of the *Principia.* This he mastered later and it "widened his horizons not by miles but by infinity".

At the age of 17 he built a shop and equipped it, making new tools as he required them. Within a year he built his first clock and within ten years his time-pieces were as accurate as those of any contemporary. All but one of his forty-odd clocks still in existence are of the "grandfather" model. Naturally he became interested in telescopes and in optics and these led into other branches of physics and astronomy. At the time there were disputes over the boundaries of the states and he blossomed out as a state surveyor. He continually improved his knowledge of mathematics and science, and in 1767 he was given the honorary M.A. degree by the College of Philadelphia. The famous planetarium, or "orrery," which he constructed between 1767 and 1771 was a marvel of accuracy. This was purchased for £300 for the College of New Jersey (now Prince-

ton) and he built a second one for the College of Philadelphia (University of Pennsylvania, from 1779). They added to his reputation. Further credit came to him from his observation of the transit of Venus in 1769.

In 1770 Rittenhouse moved to Philadelphia and his life was changed, although his heart was always in scientific investigation and the manufacture of accurate clocks. He became prominent in the American Philosophical Society and in public service. Among the offices he held were, member of the Pennsylvania Assembly, trustee of the Loan Office, engineer of public works, state treasurer, professor of astronomy and vice-provost of the University of Pennsylvania, and he was in charge of the establishing of the first U.S. mint. He also became president of the American Philosophical Society, a Fellow of the Royal Society (London) and a trustee of the University of Pennsylvania.

This biography is presented in an interesting as well as a scholarly way. At the end is a list of sources of the author's wide and precise knowledge; and following this is an adequate index. The mechanical production of the book is excellent.

C.A.C.

OUT OF OLD BOOKS

By Helen Sawyer Hogg

The Lunar Eclipse of October 4, 1884

LAST month we reprinted descriptions of several lunar eclipses of the past three hundred years during which the moon became totally invisible, even in a telescope. The eclipse of October 4, 1884 is frequently cited in textbooks as belonging in this category, but the following extracts will show that this is not the case. Although the moon appeared as faint as the Milky Way, had the brightness of only a third magnitude star, and resembled a faint, white, hazy nebula, the reports agree that it did not completely disappear.

This eclipse was not visible in North America. The *Sidereal Messenger,* vol. 3, p. 288, Nov. 1884, dismisses the eclipse as follows:

> The eclipses of the Moon and Sun on October 4 and 18, respectively, were of little interest to observers in America because invisible, and hence reports concerning them have been omitted.

Many reports of this lunar eclipse, however, appear in the journals from the other side of the water, and are most interesting reading. So many years have now elapsed since the moon appeared abnormally faint during an eclipse that it is difficult for us nowadays to visualize such an appearance. Extracts from some of these accounts to be found in Volume 45 of the *Monthly Notices,* 1884, appear below.

As observed at the Radcliffe Observatory, Oxford, by E. J. Stone.

> I merely watched the eclipse with the naked eye. The eclipse was much the darkest that I have ever seen, and just before the instant of totality it appeared as if the Moon's surface would be invisible to the naked eye during totality; but such was not the case; for with the last appearance of the bright reflected sunlight there appeared a dim circle of light around the Moon's disk, and the whole surface became faintly visible, and continued so until the end of totality.

As observed at Dun Echt by J. G. Lohse, with the 6-inch Simms Equatorial, power 91.

> During the totality the Moon was very faint, and the copper tint, so conspicuous in other eclipses, was only seen occasionally, and then only feebly,

ard not uniformly spread over the Moon, but more intense in some parts than in others.

As observed at Stonyhurst, by the Rev. S. J. Perry.

This eclipse was observed at Stonyhurst under very favourable circumstances, although the heavy dew interfered occasionally with the definition of the telescopes.

With a good binocular the Moon's disk was easily seen throughout the whole of totality, but to the naked eye there was no outline, the Moon having the appearance of a bright patch of light. The usual copper tint of the eclipsed Moon was not perceived except towards the close of the eclipse, and then it was only very slight. The general appearance in the binocular was that of a dull white ball, rather more brilliant at one part of the surface than elsewhere. The telescopes used were two equatorials of 8 and 4 inches, a 9½-inch Cassegrain, and a 7-inch Newtonian.

As observed at Harrow by Lieut. Col. G. L. Tupman.

I used the 4½-inch Cooke Refractor which is fitted with position-circle and bar eyepiece, power 66, extremely convenient for occultations.

The total light reflected from the Moon was compared directly with the stars as follows:-

At 9h 45m	G.M.T.	equal to	2 magnitude.
10 8	"		3 "
10 30	"		2 "
10 44	"		Capella

The very slight ruddy tint during totality was not perceptible until a direct comparison with white stars was made.

Observations at Bristol by W. F. Denning.

A perfectly cloudless sky enabled the total lunar eclipse of October 4 to be well observed from this city.

The most noteworthy feature in connection with the phenomenon was that the Moon, at the total phase, appeared far less luminous than usual. The remarkably opacity of the shadow became evident when it had well encroached upon the Moon's eastern limb, and the fact was fully confirmed by the aspect of her disc during the subsequent stages of the eclipse.

The firmament grew as dark as on an ordinary night when the Moon is entirely absent, and but for the indistinct outline of our satellite projected upon the dark background of the sky, there was nothing abnormal in the appearance of the heavens. Small stars could be distinguished with the customary readiness, and the Moon herself, high in the southern sky, looked like a large, ill-defined nebula with indeterminate outlines, or like a planet struggling feebly through very thick haze. Applying my 10-in. reflector, power 60, her sharply circular

contour, however, still admitted of satisfactory observation, and many leading features of the surface were recognised amid the prevailing gloom in which her landscape was involved.

Observations at Clapham, by E. J. Spitta.

The sky was cloudless, but owing to the glare of the Moon no stars before No. 74 of the Pulkova list could be recognised with the 10-inch Calver Reflector, power 60. During totality the Moon was, generally speaking, exceedingly faint —indeed, at times barely visible to the naked eye—and presented none of the coppery colour usual on these occasions. It was bluish at the lower edge as seen in the inverting telescope about 10 o'clock, when the other portion seemed brighter than at any time. No markings were plain enough to be recognised.

A particularly graphic account is that of the Rev S. J. Johnson, Bridport.

On the evening of October 4 there was a conspicuous return of the sunset after-glow that was common last winter. A peculiar state of the strata of our atmosphere might, therefore, indicate that something unusual was to be expected in the eclipse following.

At 8^h, penumbra barely perceptible with opera-glass.

At 9^h 7^m, for the first time, a very small portion of the eclipsed disk, extending only 4′ or 5′ inwards, could be discerned through the telscope, this appearing of a dark slate colour—the same tint as usually observed at the commencement of an eclipse.

At 9^h 10^m, the whole of the lunar circle began to be seen through the telescope, but without a trace of the ordinary coppery redness.

10^h 2^m, middle of totality. To the naked eye nothing could be seen but a faint nebulous spot. That the obscurity of the Moon arose from lack of illumination, not from fog or cloud, was seen by the fact that stars of small magnitudes above and below the lunar disk shone as distinctly as on an ordinary dark night. The exact appearance of the Moon at this time would be described by quoting Kepler's words verbatim about the eclipse of June (not December) 1620. "Luna difficillimè apparuit, emicuit tamen instar tenuissimae nubeculae, longè debilior quam viâ lacteâ, sine omni rubedine."

10^h 49^m 15^s, sunlight breaking out.

The shadow left the Moon near the Mare Foecunditatis about 11.48¾, the penumbra being conspicuous to the naked eye at 11.51. Thus, while the Moon did not completely disappear during totality (except to one correspondent), the peculiar features of the eclipse were the complete invisibility of the eclipsed orb until nine-tenths were covered, also subsequent to the total phase after one-tenth was uncovered. In this respect it seems similar to the earliest instance of the kind given in modern times, that observed by Kepler in 1601, an eclipse of nine-tenths of the Moon's disk. His words are (Astronomiae pars optica),

"Anno 1601 Decembri, tenuissimo cornu superstite, caliginosam tamen partem non vidi."

The usual explanation, that when the atmosphere is remarkably free from vapour the red rays would be absorbed, is hardly an adequate one.

(1) Because the atmosphere was in an equal state of dryness on the occasion of the eclipse of July 12, 1870, when the Moon assumed the usual dull red or copper colour.

(2) Because the last instance of the disappearance of the Moon was on June 10, 1816, when it could not be discerned even with telescopes, and this was one of the wettest summers in the century.

From Eruption of Krakatoa, Symonds. p. 226.

The only other subsequent lunar eclipse of importance, that of March 30th, 1885, was not visible in this country, but was observed in Tasmania by Mr. A. B. Biggs. He says that, at the time of maximum eclipse, "All within the shadow was utterly obliterated—lost in the dead slaty tint of the sky. I could not distinguish a single crater after once it was fairly within the shadow. Not the slightest trace of the coppery tint was visible throughout."

This peculiar absence of the coppery tint ordinarly visible and in circumstances which are described as having been very favourable for observation "the sky being free from clouds, and the moon in full view during the whole period of the eclipse," seems to favour the notion that the haze not only exerted a general absorption, but, as the appearance of the blue and green suns show, a selective absorption, more especially of the red end of the spectrum.

This is followed by an Editor's footnote:

Since this was in type an article by Professor Dufour has appeared in Flammarion's *'l'Astronomie,'* (January, 1888), in which he strongly supports the theory that the almost complete invisibility of the moon in 1884 was due to Krakatoa dust, and he refers to M. Flammarion having expressed the same view. On turning to M. Flammarion's original statement (*l'Astronomie*, 1884, p. 407) it will be found that he refers to the eclipses of April 25, 1642, May 18, 1761, and June 10 1816, as previous analogous cases. On comparing these and that of 1620 observed by Kepler, with Part IV., Sec. V., of this volume, it will be found that in each of these four instances there had been an eruption in the previous year—that of 1815 being the great one of Tomboro.

The eruptions referred to in the table are of Hecla, in 1619, of Taal, Luzon, in 1641, of Vesuvius, and Peteroa, Chile, in 1760. It could also be pointed out that the very violent eruption of Hecla in 1597 antedates by only four years Kepler's observations of the faint lunar eclipse of 1601.

From Flammarion, *l'Astronomie,* 1884, p. 407.

Nos lecteurs savent que l'astre des nuits a disparu entièrement pendant les éclipses de 1642, 1761 et 1816, à ce point qu'il était impossible de retrouver sa place dans le ciel.

By 1887, the atmosphere had taken on the transparency which it had temporarily lost by the Krakatoa explosion, as witness Dufour's account of the eclipse of that year, in *l'Astronomie,* 1888, p. 29.

Depuis 1884, il n'y a eu aucune éclipse totale de Lune; mais il y a eu deux éclipses partielles, une le 30 mars 1885 et l'autre le 24 septembre de la même année. Elles ont été toutes les deux à peu près invisibles pour nos latitudes.

L'eclipse du 3 août 1887 est, depuis 1884, la première pendant laquelle nous avons pu voir la région obscure; or, cette fois-là, la couleur orange sur cette région était très sensible soit avec une lunette, soit à l'oeil nu. C'est une preuve que notre atmosphère a repris, du moins en grand partie, la transparence qu'elle avait momentanément perdue en 1884.

We must conclude therefore that the last eclipse during which the moon disappeared completely, even in a telescope, was that of June 10, 1816.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

Queer Names in the Sky

In the recent war the names of far distant lands became familiar to everyone, and it is especially interesting to learn that this Journal finds its way into almost every country of the earth. Astronomy forms a natural bond uniting all nations and exerting a powerful influence for peace. It was a pleasure to receive from the tropical island of Ceylon the note printed below. It refers to a curious event in the history of astronomy.

Under the heading, 'Two Letters of a famous Astronomer', in the issue of 1944, July-August, reference is made to an unpresented letter addressed by Sir John Herschel to Niccolo Cacciatore, chief assistant and successor of Giuseppe Piazzi, Director of the Royal Observatory at Palermo.

It is interesting to recall that this assistant decided to immortalize himself in a manner all his own, rightly anticipating that posterity would not otherwise perpetuate his name. Fired with this somewhat unworthy desire he accordingly Latinized his name, which means Nicholas the Hunter, into Nicolaus Venator. Apparently beset by a sense of his own unworthiness coupled with a natural reluctance to have his ambition foiled if he was readily discovered, Cacciatore hit upon the expedient of reversing the spelling and thus camouflaging his identity. In this guise the names appear for the first time in the Catalogue issued by the Observatory in the beginning of the nineteenth century as those of the stars alpha and beta of the pretty little diamond-shaped Dolphin, which heralds the Winged Horse of Pegasus.

The astronomer Admiral W. H. Smith, a quondam student under Piazzi, completely mystified, called Svalocin 'cacaphonous and barbaric' and declared of Rotanev that 'it putteth derivation and etymology at defiance', although R. A. Proctor described them as 'pleasing names'. The Rev. T. W. Webb explained the little puzzle.

Mention may be made that of some 650 names of lunar formations, representing persons not all necessarily connected with astronomy, not one commemorates the Sicilian assistant.

Dehiwala, Ceylon, May 3, 1946. A. T. Gurunather Brito.

War Mad — Consult the Oracle !

During the recent war there were newspaper statements that Hitler had a personal astrologer in attendance, and other stories were in circulation indicating a serious falling away from well-established

scientific beliefs. One found it difficult to give credence to such reports and preferred to hope that some reporters were too fond of picturesque remarks. However in *Popular Astronomy* for June 1946 Dr. Gerard P. Kuiper, of the Yerkes and McDonald Observatories, contributes a long article on "German Astronomy during the War," the information for which he obtained during personal visits to Germany during the period April-September 1945. From this a few paragraphs are taken:

One of the symptoms of intellectual deterioration in Nazi Germany was the widespread use of pseudo-scientific theories. Not only was astrology widely practiced even in Hitler's headquarters but the theory of the world-ice was popular as well as the theory that the world was a hollow shell, with the human race living on the inside (Hohlwelttheorie). The following illustrations may suffice:

(a) Dr. W. Führer, a graduate of Kiel (Rosenberg, Unsöld) and later an associate of the physicist Lenard at Munich, was "Referent [referee] für Mathematik Astronomie and Physik," 1940-43. In this important capacity he had a large share in making Nazi appointments to German universities (e.g., the successor to Sommerfeld!). In 1943 he reportedly became official astrologer for Himmler and Hitler, at the Führer's headquarters.

(b) Certain German Naval circles believed in the Hohlwelt theorie. [hollow world theory] They considered it helpful to locate the British fleet, because the curvature of the earth would not obstruct observation. Visual rays were not suitable because of refraction; but infrared rays had less refraction. Accordingly a party of about ten men under the scientific leadership of Dr. Heinz Fischer, an infrared expert, was sent out from Berlin to the isle of Rügen to photograph the British fleet with infrared equipment at an upward angle of 45°.

(c) Other groups, including officers of flag rank, practiced or supported "Pendelforschung" [pendulum investigation]: a large map of the Atlantic was spread out horizontally, with a 1-inch toy battleship as test object. A pendulum, consisting of a cube of metal (about a cubic centimetre) and a short string was swung above the battleship. If the pendulum reacted it proved the presence of a true battleship at that location.

Dr. Kuiper gives further examples; but it is more hopeful and pleasing to read:

Most scientists did not support the anti-intellectualism of the Nazis, and combatted the pseudo-scientific theories (though not always the racial theory). . . In fairness it should be stated that the milder forms of pseudo-science are not confined to Germany.

C. A. C.

THE ATOMIC BOMB—THE NEED OF PEACE

The Review for 1945 of the work of the Rockefeller Foundation by its president, Raymond B. Fosdick, contains many interesting statements and thoughtful discussions:

> With many other organizations The Rockefeller Foundation played a part—an unwitting part—in the creation of the atomic bomb. A number of the leaders of the project—23 of them, in fact—had received part of their specialized training on fellowships provided by Rockefeller funds.... The departments of physics and chemistry at such institutions as Princeton and the University of Chicago, which provided many key figures on the staff of the project, had received liberal support from Rockefeller funds.
>
> This record is set down solely to emphasize the point that when these various grants were made, no one was thinking of an atomic bomb. The only motive behind this support was to extend the boundaries of knowledge, to stimulate the search for truth, in the belief that there is no darkness but ignorance. . . . But it is this same search for truth that has to-day brought our civilization to the edge of the abyss . . . and has most endangered the possibility of human life on this planet. . . .
>
> Almost any discovery can be employed for either social or antisocial purposes. The German dye industry was not created to deal with either medicine or weapons of war; and yet out of that industry came our sulfa drugs and mustard gas. When Einstein wrote his famous transformation equation in 1905, he was not thinking of its possible military applications; but out of that equation came one of the principles upon which the bomb was based. The great 200-inch telescope that is just being completed on Mount Palomar in California will expand our comprehension of the distant limits of space and the remote depths of time; but this same instrument, probing the secrets of astrophysics, could conceivably lead to more frightful methods of destruction than those involved in atomic energy. . . .
>
> The mighty imperative of our time, therefore, is not to curb science but to stop war — or, to put it another way, to create the conditions which will foster peace.

The present writer has devoted much of a long life to the study of the problems of matter or the consideration of forces throughout space, and he often thinks that there is too much shrieking about what is going to happen; but there is considerable satisfaction in knowing that those nations which are the most powerful in the matter of atomic research are the most anxious to have peace in this world.

C. A. C.

AURORA SEEN AT OTTAWA, FRIDAY, JULY 26, 1946

We first noticed a yellowish-green glow in the southern sky at about 8.45 p.m., (E.D.T.). The light was in the form of a wide arc above the horizon with a sharply defined lower boundary and a diffuse upper edge. A little later, faint streamers appeared in the north and were seen intermittently over the entire sky. All appeared to converge toward the magnetic zenith. At one time two long rays, approximately north-south and east-west, crossed overhead. A stronger ribbon of light was then formed, extending completely across the sky from east to west; this ribbon was about one degree wide at the zenith and wider at the horizon and was distinguished by a broad S near the zenith. There were two or three such ribbons, fading and reappearing in slightly different positions, the last being very broad and split at the zenith. At intervals a small corona was formed.

The original glow in the south travelled slowly toward the west, and various columns and folds appeared above it. Most of the aurora had the usual yellow-green colour, but at one time a pronounced rose curtain was formed in the southwest and moved slowly further west. Some rose, violet, and orange streamers occurred at intervals during the remainder of the aurora.

At about 10.30 a diffuse curtain of streamers appeared in the south, extending from the horizon half way to the zenith. Gradually it was intensified into a brilliant glow and rose toward the zenith. At this time there was no aurora in the northern sky. Suddenly, when the streamers approached the zenith, a half-corona burst out toward the south (at 10.58) and a little later was completed in the north also. At first the rays seemed to twist around a dark centre, but this finally became flooded with light as well; the colour at the zenith was nearly white. Immediately, flaming aurora began, with waves apparently traveling upward on all sides along the ray structure. At this point the aurora extended only about 45° toward the northern horizon with a very sharp cutoff. The rays were gradually extended downward until finally a complete umbrella of streamers existed. The display faded slowly, then flaming aurora occurred once more, and finally the phenomenon diminished to a gentle glow by 12.00 o'clock.

A. E. and C. R. COVINGTON

MEETINGS OF THE SOCIETY

AT EDMONTON

October 11, 1945—The President called the meeting to order at 8:18 p.m. The minutes of the previous meeting were read and approved.

The president called on the members to stand for a few moments in tribute to the late Mr. John Blue, a past president of this Centre.

The center heard with regret that Mr. Wates could no longer undertake to give the HANDBOOK talks. The members hope his health will improve.

The speaker of the evening was Dr. Campbell, who gave an eclipse post mortem. He told about the people who organised the expedition to Bredenbury, and showed various photographs of them constructing and testing the apparatus. All the apparatus was mounted on several platforms hinged at one edge, and capable of a small rotation about a polar axis. The many problems involved in getting these "barn door" mountings sufficiently rigid and accurate were explained. Parts of a note from Dr. Harold Johns, which accompanied the photographs, were read to the meeting.

Finally the progress of the weather for several days before and during the eclipse was described, as was the feelings of the corps of observers during the critical cloudy time.

The meeting adjourned at 10 to Room 111 for refreshments, and any discussion and questions were dealt with individually over the cups. There were 35 members and visitors present.

November 8, 1945—The President called the meeting to order at 8:16 p.m.

The minutes of the previous meeting were read and approved.

There was a letter from Toronto asking for spare copies of the September JOURNAL, if any are available.

New Business: The President appointed a nominating committee consisting of Messrs. Campbell, Dean and McAulay.

Mr. Montgomery was named auditor for 1945.

The HANDBOOK talk was given by Dr. Campbell. Castor and Pollux are prominent in the eastern sky during the evening. Just below them are Mars and Saturn. Reference was made to the phenomena known as harvest moon and hunter's moon.

Due to the illness of Mr. Stockwell, the main paper was given at very short notice by Professor E. S. Keeping, who took as his subject "The Milky Way." This is a band of faint light high overhead in summer. There are many mythological stories supposed to explain its origin. It has been the inspiration of many paintings by famous artists, for example, Tintoretto and Rubens. Its nature has been argued about by many philosophers, until the telescope finally proved it to consist of stars. Its appearance in slides photographed through various telescopes was made plain by several examples.

Observations on the number of stars visible in various directions give some idea of the shape of what is now called our galaxy. The bright and dark nebulous patches are due to clouds of gas. The shape and other characteristics are inferred from long exposure photographs of other nebulae which are seen in many aspects. Enormous distances and aeons of time are involved in the universe as revealed by the telescope and photographic plate, and these are now at least dimly comprehended by the human mind.

After some questions and discussion the meeting adjourned to Room 111 for refreshments. There were 21 members and visitors present.

December 13, 1945—In opening the meeting, which was the annual dinner meeting, the President, Dr. Cook, decreed that everyone must introduce the person on his right, and this happy innovation was enjoyed by everyone. The call to order came at 8:05.

The minutes of the previous meeting were read and approved.

A motion electing Miss Mary Noy to associate membership was introduced by Mr. Robertson and Mr. Dean.

The treasurer's report, showing a satisfactory balance, was moved by Miss Kiernan, and carried.

Mr. Keeping read a report on the operation of the Library.

Dr. Campbell reported on the public and private use of the Observatory during the year. Sometimes the crowd had been too large to handle conveniently.

The Secretary's report was moved by the secretary, seconded by Mr. Kiernan, and carried.

The report of the nominating committee was presented by Mr. Dean. As there were no further nominations from the floor, this report was seconded by Mr. Stockwell and carried. The officers elected are listed elsewhere in the JOURNAL.

The usual business motion authorizing the new executive to transact business and the President and Treasurer to sign cheques, was moved by Mr. Gowan, seconded by Mr. Keeping, and carried.

It was moved by Mrs. Clarke, seconded by Mr. Kiernan that the Secretary write a letter to Mr. Wates expressing good wishes for his recovery, and appreciation for all he has done for the Centre.

The HANDBOOK talk was given by Dr. Campbell. There is a total eclipse of the moon on December 18 early in the evening. The same planets are on display as in November. He referred to an account in the magazine *Sky and Telescope* of the Christmas star.

The main paper of the evening, "Astrology and Medicine," was given by Dr. Heber Jamieson. He outlined the basis of Astrology from early days. The whole thing is based on analogy due to real or supposed similarity between the heavens and the earth, and between other natural objects or processes and man or parts of man. Predictions look very detailed, but on closer examination are seen to be couched in vague terms. That the ideas were a part

of ordinary life in earlier times was shown by quotations from the Bible, Chaucer, and Shakespeare. At present there are many Astrological magazines; they impress by the complication of horoscopes but the reasoning by analogy alone is as shaky as ever. After some questions and discussion the meeting adjourned before 10 o'clock. There were 43 members and visitors present.

January 10, 1946.—The president called the meeting to order at 8:18 p.m. The minutes of the previous meeting were read and approved.

Correspondence: The secretary read parts of a letter from Mr. C. Constant, now living in Texas; a Christmas card from Mr. Speed; and a letter from the World Calendar Association regarding calendar reform. It was moved by Mr. Stockwell, seconded by Mr. Blower, that this letter be tabled for future consideration. Carried.

Applications: Mrs. R. N. Shaw, 11128—90 Ave. The usual motion accepting the nomination was passed unanimously.

The main paper on the Ecliptic and Planetary Motions was given by Mr. Alex Stockwell. The ecliptic and zodiac were originally conceived with the seven planets corresponding to the seven openings in the head. The early discovery of the precession of the equinoxes was the result of systematic and careful observation. The facts were explained by a diagram, and illustrated by a precessing gyroscope. The normal period of 26,000 years was compressed into about as many seconds.

Copernicus' ideas and Kepler's Laws of planetary motion were outlined and explained. Reference was also made to Bode's Law, which may only be a coincidence. The appearance and characteristics of the motion of inferior and superior planets were described. An interesting feature is the apparent retrograde motion as compared to the stellar background.

There was some discussion and several questions after the paper.

About 9:30 the meeting adjourned to Room 111 for refreshments. There were 24 members and visitors present.

E. H. Gowan, *Honorary Secretary.*

AT WINNIPEG

April 10, 1946.—The regular meeting was held in Theatre A, University of Manitoba Building; Miss Olive A. Armstrong, the President, introducing the speakers. Mr. W. R. Junkin spoke to the junior members for 20 minutes on Venus, illustrating his lecture with blackboard drawings.

Following this, Professor W. A. Anderson of the Physics department, University of Manitoba, gave a feature lecture on "Nuclear Energy", profusely illustrated in colours, and traced the development of transmutation from Rutherford's initial experiment in 1919 down to the present, including the production of synthetic neptunium and plutonium and the extraction of U-235, illustrating the various separation processes. Prof. Anderson followed his technical lecture with philosophical deductions on the possibility of utter destruction of civilization on one

hand or vast benefits to mankind on the other hand; Nature entrusting us with a vast source of energy before we have exhausted the sources we have been accustomed to. Following the lecture, Mr. Norris-Elye thanked the speaker for an exceptionally good lecture.

L. W. KOSER,
Recorder

AT LONDON

April 12, 1946.— The regular meeting was held in the Hume Cronyn Memorial Observatory, University of Western Ontario.

Dr. R. C. Dearle, head of the Physics Department, University of Western Ontario, addressed the members on "Problems and Promises from Atomic Energy." Explaining the historical background of the origin of the atomic theory he continued with the comparatively modern enunciation of John Dalton that atoms were the ultimate bits of mater, indivisible, eternal and indestructible. By means of slides Dr. Dearle demonstrated the modern knowledge of atomic structure describing in detail protons, neutrons, electrons and isotopes.

The recent use, or misuse, of atomic energy in the bombing of Hiroshima and Nagasaki were mentioned by Dr. Dearle, and although the working of the atomic bomb is still an official state secret he was able to convey to the members some idea of the chain reaction resulting in the emission of energy by the scientific processing of uranium. During research two new elements had been discovered heavier than uranium, he said, neptunium and plutonium.

Concluding his remarks the speaker dealt in scientific generalizations, stating that civilization progresses in spite of the misuse of experiment and research. Man should use his own intelligence to solve the problem of nuclear research. The promise of atomic power was still only a vision as science had as yet been able to release less than 1/10 of 1 per cent. of the energy inherent in matter.

Dr. Dearle's address was highly appreciated by the audience.

After a short question period, and the serving of refreshments, adjournment was at 10:45 p.m.

May 27, 1946.—The regular meeting was held in the Hume Cronyn Memorial Observatory, University of Western Ontario.

On motion of Dr. Magee, Mr. L. G. Speers of Port Stanley was elected a member of London Centre.

The speaker of the evening was Dr. J. A. Pearce, director of the Astrophysical Observatory at Victoria, B.C. who spoke on the Pleiades Cluster. Dr. Pearce began by giving the origin of the name of this notable star cluster. Tracing back into Greek mythology he stated that the name which most appealed to him was that inferred in the legend that they were the daughters of Pleione and Atlas.

These stars, he estimated, were 240 light-years distant and normal vision could discern anywhere from 6 to 13 individual stars contained in the grouping although photographic plates have proved the existence of over one thousand stars in the

cluster. By means of numerous slides, most of which had been taken by the lecturer, he demonstrated the radial velocity of the more prominent stars. It was interesting to observe the slide which showed the direction in which each star of the group was travelling and the positions they would take after several thousand years. One of the misnomers given to this astronomical group, Dr. Pearce said, was the "little dipper."

A brief social period supervised by Mrs. Watt and Mrs. Spratt followed the lecture during which the members were able to fraternize and to meet Dr. Pearce.

A. EMSLEY,
Secretary

AT VANCOUVER

October 10th, 1945.—The first meeting of the fifteenth session of the Vancouver Centre was held in the Science Building at the University. The speaker of the evening was Dr. G. M. Shrum, Head of the Departments of Physics and University Extension at the University of British Columbia, and Honorary President of the Centre, who spoke on "Atomic Energy".

The speaker stated that the fundamentals of atomic energy were well known to scientists before 1939 so that the only secrets in recent developments are the engineering details. Any nation can build similar weapons to the atomic bomb in a very short time. Dr. Shrum stated that there has been very little exchange of scientific information between the Western Allies and Russia. Canada is vitally interested in the atomic bomb, since the chief research work in the British Empire was done at the Montreal Laboratories of the National Research Council, a plant for producing material was built at Chalk River, Ont. and because there are deposits of pitchblende at Great Bear Lake.

The speaker demonstrated the use of a Geiger Counter to detect the presence of radioactive ores.

In 1850 Joule propounded the theory of Conservation of Energy which states that the total amount of energy in the universe is constant. The sun is pouring out energy at such a rate that if it was made of burning coal or even of radium it could not have been emitting energy very long. However the theory of evolution requires the sun to have had a long life. One of the results of Einstein's theory of relativity is that a small amount of mass is equivalent to a large amount of energy. The problem lies in the mechanism by which mass can be turned into energy.

Matter is composed of atoms each about one hundred millionth of a centimeter in diameter. Work in the early part of this century showed that the heavy part (nucleus) of an atom occupies only a small part of the total volume. A working model of each of the known elements was soon obtained. The heaviest elements are radioactive, for example radium and uranium. The speaker then discussed isotopes or atoms of the same element having the same chemical properties but different atomic mass. Uranium consists of three isotopes of atomic weights 240, 238 (most common) and 235 (rare, being only 1/140 of all existing).

An Italian scientist, Fermi, tried bombarding the nuclei of elements with slow neutrons (uncharged particles with the same weight as the hydrogen atom). He obtained no success with uranium but early in 1939 Hahn and Meitner found that U 235 broke up into two large parts while some mass was converted into energy. Also three neutrons were produced which could be used to break up more U 235 and hence develop a large amount of energy. Also research produced new elements heavier than uranium, one being called plutonium also breaking up like U 235.

The speaker could not predict the further development of atomic energy. During the war research was accelerated and such research should be kept up. Greater stocks of uranium than we now have will be needed before it can be used to produce power.

At the conclusion of his lecture Dr. Shrum answered questions from the audience.

November 13th, 1945.—The regular meeting of the Vancouver Centre was held in the Science Building, University of British Columbia. The speaker was Dr. D. C. Murdoch of the Department of Mathematics at the University, whose subject was "Maps and Map Projection".

The speaker discussed various forms of map projections pointing out advantages and disadvantages of each. Map projections can be classified into two main types. The first is equivalent in which equal areas on the earth are represented by equal areas on the map. This causes distortion of form. The other main type is conformal in which at every point the scale on meridians and parallels is the same so that angles are preserved. It is impossible to have both equivalence and conformality so to avoid too much distortion either in shape or area most maps are compromises of the two.

Archimedes proved that a cylindrical projection (projection on a cylinder tangent to the equator by planes parallel to the equatorial plane) will give equal areas on sphere and cylinder. Hence such a projection is equivalent. The common Mercator map is a cylindrical conformal projection.

Projection on a tangent plane is the characteristic of perspective projections. A central perspective projection is known as gnomonic and on it great circles (the shortest distance between two points on a sphere) map into straight lines. Projection from the south pole on a plane tangent at the north pole gives a stereographic projection (conformal). Orthographic projection is obtained by dropping perpendiculars from surface to the plane. By choosing an external point of projection Clark's minimum error maps are obtained.

Other projections used include various conical projections and zenithal projections.

December 11th, 1945.—The annual meeting of the Centre was held in the Science building at the University. The officers proposed by the Nominating Committee were unanimously elected for the year 1946.

The speaker for the meeting was Dr. A. M. Crooker, of the Department of Physics, University of British Columbia, who during the war was in charge of optical design for Research Enterprises Limited in Toronto. His subject was "Military Telescope Making".

Dr. Crooker began by stressing the importance of military telescopes in fire control. To make telescopes the first requisite is glass—clear, colourless, and free from defects. At the outbreak of the war no optical glass had been made in Canada. Only one-tenth of one per cent. of all glass made is optical glass. The speaker outlined the procedure involved in making optical glass.

For military use refracting telescopes giving an erect image are required. They are designed to have only a low magnification (about 1.5 for tanks) since high powers restrict the field of view too much. In refractors each lens has to have two components, one made of crown glass, and one of flint. These components must be accurately centred. Graticules (cross-hairs) are necessary in the telescope to provide a scale. They should have a large exit pupil to make the telescope more valuable as a night glass and also to render the position of the eye less critical.

Dr. Crooker showed to the audience several binoculars, telescopes, and prisms.

January 8th, 1946.—The regular meeting of the Vancouver Centre was held in the Science Building at the University. The speaker was Dr. C. S. Beals of the Dominion Astrophysical Observatory at Victoria, who took as his subject "The Practical and Commercial Value of Astronomy".

Dr. Beals said that most people are attracted to astronomy more by aesthetic interest in the beauty of the heavens and a desire by finding out about science to become more in harmony with the physical world than by interest in its practical applications. However astronomy has been of great practical value. Historically the interest in astronomy is older than the interest in terrestrial physical science. Much interest in physical science was fostered by astronomers, for example in mechanics, Copernicus, Tycho Brahe, Galileo, and Sir Isaac Newton. Other contributions of astronomy lie in the development of the calendar, timekeeping by astronomical observations, surveying, navigation, and some parts of mathematics. The speaker also stated that many optical instruments were developed by astronomers. One of these is the spectrograph which is a very powerful instrument for research. Much valuable information about atomic structure is obtained by its astronomical use since in the stars and in interstellar space conditions of temperature and pressure unobtainable on earth are found. To explain the source of the energy of the stars astronomers developed the theory of certain atomic energy reactions.

Dr. Beals mentioned the effect of astronomical discovery on human thought. The discovery that the earth was not the centre of the solar system and the universe had much influence.

After the end of the lecture there was considerable discussion on various topics.

February 12th, 1946.—The regular meeting of the Vancouver Centre was held in the Science Building at the University, the speaker being Dr. J. A. Pearce, Director of the Dominion Astrophysical Observatory, Victoria. Dr. Pearce took as his subject "Galactic Rotation" on which he is an authority, he and the late Dr. J. S. Plaskett having carried out a considerable investigation of the problem of the rotation of our galaxy.

Dr. Pearce first discussed the size and shape of the galaxy. The first model of the galaxy was given in 1783 by William Herschel. Later estimates gave a considerably larger size but some of these have been somewhat reduced by taking account of the presence of absorbing material in the galaxy.

The first suggestion of galactic rotation was made by Sir John Herschel who based it on the fact that a lens-shaped galaxy could not be in equilibrium unless it was rotating. He suggested a study of the proper motions of the stars to determine the rotation. In later work both proper motions and radial velocities have been used to do this. The large random motions of the stars superimposed on the rotation of the system as a whole causes difficulty in evaluating the rotation so averages of the motion of large numbers of stars must be taken.

The lecturer illustrated his talk with a large number of slides.

March 12th, 1946.—The regular meeting of the Vancouver Centre was held in the Science Building, University of British Columbia. The speaker was the President of the Centre, Dr. H. D. Smith of the University Physics Department who took as his subject "Eclipse—1945". Dr. Smith was a member of the Harvard eclipse expedition which went to Bredenbury, Saskatchewan, to observe the solar eclipse of July 9th, 1945.

The speaker began with a short explanation of the cause of eclipses. Total eclipses of the sun are rare events. On the average there is a period of 360 years between two total eclipses at the same point on the earth. Eclipses occur when the sun, moon, and earth are in the same line—solar eclipses when the moon is between the earth and sun (at new moon) and lunar eclipses when the earth is between the sun and moon (at full moon). If the orbit of the moon was in the same plane as the orbit of the earth around the sun there would be one solar and one lunar eclipse every month, but since there is an angle of five degrees between the planes of the orbits eclipses can only occur when the node of the moon's orbit (place where the moon's orbit intersects the plane of the earth's orbit) is near the line joining the earth and sun. This occurs twice in an eclipse year of 346 days. The duration of an eclipse depends on the distances sun and moon are from the earth. If the moon is too far from the earth only an annular eclipse can be seen, that is the moon is surrounded by a ring of light. It was discovered by the Babylonians that very similar eclipses occurred after a period of 18 years 10 1/3 days which they called the Saros. This is the least common multiple of the lunar month and the eclipse year. The occurrence of eclipses can be predicted for hundreds of years in advance and tables have been prepared giving data on these. The most complete tables give the circum-

stances of 8000 solar and 5200 lunar eclipses from 1207 B.C. to 2161 A.D. calculated out.

After this summary of the theory of eclipses Dr. Smith told of his experiences with the eclipse expedition to Bredenbury. This was illustrated by slides. Although this expedition had some of the best equipment ever taken on an eclipse expedition they were very unfortunate in that the sky was so overcast that they were unable to observe the sun.

April 9th, 1946.—The final meeting of the 1945-46 session of the Vancouver Centre was held in the Science Building, University of British Columbia. The speaker was Dr. K.C. Mann of the Department of Physics of the University, who took as his subject "The Story of a Radar Set". Dr. Mann was on leave of absence from the University during the war doing work on radar at the National Research Council and at Research Enterprises Limited.

Dr. Mann began his lecture by briefly explaining the principles of radar. This was illustrated with diagrams and photographs of some radar equipment. The speaker then went on to tell the story of the Canadian made 268 set which is now being installed on merchant vessels for navigation purposes. Dr. Mann played a very important part in production of this set, first on design at the National Research Council and later as production engineer at Research Enterprises Limited. He began with the Admiralty specifications when the National Research Council was asked to design a new radar set for motor torpedo boats. He briefly described the design work and the tests on the pilot model. He then went on to discuss the production of the sets mentioning a few of the troubles which were experienced in this work.

C. D. MAUNSELL, *Recording Secretary.*

The Royal Astronomical Society of Canada

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